Arctic Conservation, Observation, Research and Engagement (ArcticCORE) program: 2024 Oceanographic Expedition Report

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Arctic Conservation, Observation, Research and Engagement (ArcticCORE) program: 2024 Oceanographic Expedition Report

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ABSTRACT

Burgers, T., Kitching, E., Reimer, J., Charette, J., Pućko, M., Lee, M, Mandryk, R., Barut, G., Capelle, D., Ardyna, M., Matthes, L.C. 2026. Arctic Conservation, Observation, Research and Engagement (ArcticCORE) program: 2024 Oceanographic Expedition Report. Can. Manuscr. Rep. Fish. Aquat. Sci. 3355: vii + 35 p. https://doi.org/10.60825/wkqe-7e27

Tuvaijuittuq, meaning "the place where the ice never melts" in Inuktut, is a globally unique region because multi-year sea ice, large ice shelves and glaciers persist, altering marine water properties and coastal biogeochemical cycles. The region is expected to become a future haven for ice-associated species in the Canadian High Arctic as sea ice cover continues to decline rapidly. To support decision-making on co-management and conservation strategies in the Tuvaijuittuq Marine Protected Area (MPA), Fisheries and Oceans Canada (DFO) implemented the Arctic Conservation, Observation, Research and Engagement (ArcticCORE) research program to provide critical baseline oceanographic information on the marine ecosystem and emerging ecosystem stressors. This report presents an overview of the logistics and physical, chemical and biological sampling of the 2024 ArcticCORE oceanographic expedition on board the CCGS *Amundsen*. Sampling occurred within northern Baffin Bay, Jones Sound, Smith Sound, and in multiple fjord systems on either side of Nares Strait reaching as far north as the Lincoln Sea to characterize waterways connecting the Arctic Ocean and multiple smaller freshwater sources to Baffin Bay. The primary ArcticCORE expedition leg took place between 8 August and 5 September 2024, during which 22 stations were sampled for physical and biogeochemical oceanographic variables and six DFO-led moorings were recovered with two DFO-led moorings being re-deployed. Additional oceanographic data were collected at 17 stations within the same region by our academic collaborators during a subsequent leg of the CCGS *Amundsen* expedition between 5 September and 3 October 2024. The extensive dataset resulting from this expedition will provide crucial baseline information on the structure, functioning, productivity and ecological linkages of the food web of Tuvaijuittuq and its connected outflow regions, and serve as a foundation for sustainable management and conservation initiatives in this unique High Arctic marine ecosystem.

RÉSUMÉ

Burgers, T., Kitching, E., Reimer, J., Charette, J., Pućko, M., Lee, M, Mandryk, R., Barut, G., Capelle, D., Ardyna, M., Matthes, L.C. 2026. Arctic Conservation, Observation, Research and Engagement (ArcticCORE) program: 2024 Oceanographic Expedition Report. Can. Manuscr. Rep. Fish. Aquat. Sci. 3355: vii + 35 p. https://doi.org/10.60825/wkqe-7e27

Tuvaijuittuq signifie « l'endroit où la glace ne fond jamais » en inuktitut est une région unique à l'échelle mondiale puisque la glace de mer pluriannuelle, les larges plateformes de glace et les glaciers y persistent, altérant les propriétés de l'eau de mer et les cycles biogéochimiques en région côtière. Il est prévu que cette région devienne, dans le futur, une oasis pour les espèces qui dépendent de la glace dans le haut Arctique canadien alors que le couvert de glace de mer continue à diminuer rapidement. Afin de supporter la prise de décision pour les stratégies de cogestion et de conservation dans la zone de protection marine (ZPM) de Tuvaijuittuq, Pêches et Océans Canada (MPO) a établi le programme de recherche Arctique Conservation, Observation, Recherche et Engagement (ArcticCORE) afin de fournir d'importantes informations océanographiques de référence sur l'écosystème marin et les stresseurs écosystémiques émergents. Ce rapport présente un aperçu de la logistique et de l'échantillonnage physique, chimique et biologique de l'expédition océanographique ArcticCORE 2024 à bord du NGCC Amundsen. L'échantillonnage a eu lieu dans le nord de la baie de Baffin, dans le détroit de Jones, ainsi que dans plusieurs systèmes de fiords des deux coté du détroit de Nares, jusqu'à la mer de Lincoln, afin de caractériser les voies connectant l'océan Arctique et plusieurs petites sources d'eau douce à la baie de Baffin. Le leg principal de l'expédition d'ArcticCORE 2024 s'est déroulé entre du 8 août au 5 septembre 2024, période durant laquelle 22 stations furent échantillonnées pour des variables océanographiques physiques et biogéochimiques. Six mouillages, menés par le MPO furent également récupérés, parmi lesquels deux furent redéployés. Des données océanographiques additionnelles furent collectées à 17 stations, situées dans la même région, par nos collaborateurs universitaires lors du leg subséquent de l'expédition du NGCC Amundsen, entre le 5 septembre et le 3 octobre 2024. L'importante base de données produite lors de cette expédition fournira des connaissances de base déterminantes sur la structure, le fonctionnement, la productivité et les liens écologiques au sein du réseau trophique de Tuvaijuittuq et des régions adjacentes, servant de fondement aux initiatives de gestion et de conservation durables dans cet écosystème marine unique de l'extrême arctique.

1. RATIONALE AND OVERVIEW OF THE ARCTICCORE PROGRAM

In August 2019, Tuvaijuittuq was established as an interim Marine Protected Area (MPA) for a period of 5 years, further renewed in 2024, to protect and better understand this remote region that contains the oldest and thickest sea ice and is considered a refuge for ice-associated species in a rapidly changing Arctic (e.g., Fol et al., 2025, Newton et al., 2021, Pućko et al., 2026, Figure 1). Tuvaijuittuq, meaning "the place where the ice never melts" in Inuktut, represents a globally unique region because of the persistent multi-year sea ice (MYI) pack and massive glaciers that alter marine water properties and coastal biogeochemical cycles (https://www.dfo-mpo.gc.ca/oceans/mpa-zpm/tuvaijuittuq/index-eng.html; accessed on 26 October 2026). The region is expected to become a future haven for ice-associated species in the Canadian High Arctic as sea-ice cover continues to decline rapidly. Additionally, the region holds significant cultural importance for Indigenous communities and has traditionally been used for travel and harvesting (DFO 2020). The designation of Tuvaijuittuq as a MPA was based on the need to protect and conserve the region's biodiversity, structural habitat, and ecosystem function considering continuing declines in sea ice extent, duration, and thickness and the associated increasing accessibility of the region to shipping and other human activities (AMAP 2017). Moreover, due to the extremely remote location of Tuvaijuittuq and relative inaccessibility brought on by the same thick ice cover, relatively little is known about the sea-ice dependent ecosystem structure, productivity, and dynamics. This information is needed to inform conservation initiatives in the region and connected downstream systems such as Sarvarjuaq/Pikialasorsuaq (the North Water Polynya), a biologically productive and culturally Arctic ecosystem, and is therefore a mandated priority for DFO.

The Arctic Conservation, Observation, Research and Engagement (ArcticCORE) program was implemented by Fisheries and Oceans Canada (DFO) to continue research in Tuvaijuittuq and connected ecosystems, and as a follow-up to the pioneering scientific work carried out within the DFO-led Multidisciplinary Arctic Program (MAP) – Last Ice initiated in 2017 (Charette et al., 2022, Michel & Lange 2018, Michel et al., 2019). The overarching goal of the ArcticCORE program is to better understand the role of sea ice in this understudied region of the Canadian Arctic, and to provide critical baseline oceanographic and ecosystem knowledge of the unique and

rapidly changing ecosystems in Tuvaijuittuq (e.g., sea -ice, marine and estuarine systems, glacier-connected fjords) and their emerging ecosystem stressors, and to support future decision-making on co-management and conservation strategies (DFO 2020). The main components of the ArcticCORE sampling program include: 1) sea ice and ocean physical and chemical characterization and interactions; 2) spatial distribution diversity and productivity of primary producers; 3) distribution, abundance and composition of zooplankton and fish communities; 4) sinking export to benthic communities and sediment biogeochemistry; 5) ecosystem health and interactions, including food web biomarkers; and 6) distribution, abundance and habitat usage of marine mammals. The ArcticCORE program includes ship-, ice- and aerial-based research as well as long-term observations (e.g., moorings).

The research focus of the 2024 ArcticCORE oceanographic expedition aboard the CCGS *Amundsen* was to better characterize the marine ecosystems in eastern Tuvaijuittuq, including the northern reaches of Nares Strait and the Lady Franklin Bay – Archer Fiord system, as well as adjacent ecosystems in Jones Sound and in many glacial fjords of Nares Strait (Figure 1). Field observations of physical and biogeochemical ocean conditions, including the carbon cycle, light and nutrient availability, the diversity and abundance of microalgal, zooplankton, fish, and benthic communities, and sinking export to depth within these regions will provide for an integrated approach and holistic perspective on marine ecosystem components and existing links. Additionally, the recovery (and some re-deployments) of long-term observation platforms (moorings) will provide year-round hydrographic measurements.

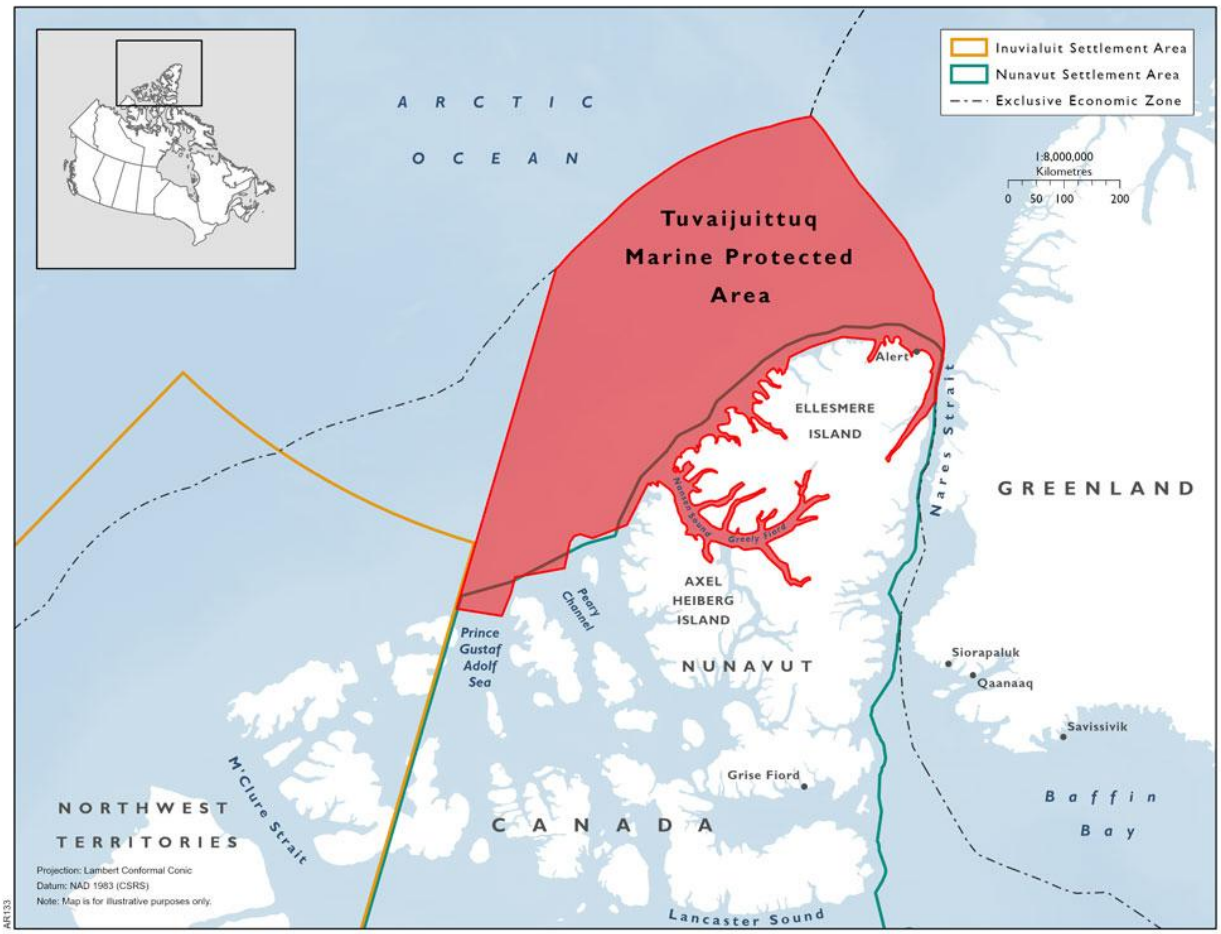


Figure 1. Boundaries of the Tuvaijuittuq Marine Protected Area in the Canadian High Arctic (DFO 2026).

2. EXPEDITION HIGHLIGHTS

The 2024 ArcticCORE oceanographic expedition aboard the CCGS *Amundsen* conducted extensive scientific sampling of the eastern marine environments of Tuvaijuittuq including many glacier-influenced fjord systems of Nares Strait, reaching as far north as the Lincoln Sea (Figure 1). In 2024, the ArcticCORE team also closely collaborated with the research initiative 'Refuge Arctic' (RA, https://www.refuge-arctic.ulaval.ca/), led by the International Research Laboratory Takuvik (Université Laval/CNRS/Sorbonne Université). This international, multidisciplinary initiative aimed to better understand the sea ice, marine and coastal ecosystems of the larger Last Ice Area by collecting physical and biogeochemical oceanographic data during two legs of the CCGS *Amundsen* expedition. The close collaboration between these two programs enabled high-

resolution sampling and a more holistic view of all marine ecosystem components of this important Arctic outflow region.

During leg 3 of the expedition, between 12 August and 4 September, a comprehensive suite of physical and biogeochemical measurements was performed at 22 stations. This included the first comprehensive oceanographic surveys of many glacier-influenced fjords including Archer Fiord, Dobbin Bay, Cadogan Inlet, and Makinson Inlet along the Canadian coastline of Nares Strait and Newman Fiord on the Greenlandic side. ArcticCORE scientific activities included seawater sampling for key biochemical variables and net deployments to investigate the zooplankton community, complemented by scientific activities led by collaborators (e.g. primary production, fish community, trace metals, sediment). Complementary operations using the ship's barge and helicopter enabled additional near-shore sampling within fjords, and direct samples from freshwater sources such as glacier ice, melt ponds on the ice surface, rivers, and lakes. Although a maritime search and rescue call on 31 August prevented the team from sampling all of the planned stations in Jones Sound, the team successfully re-sampled two stations from the 2023 ArcticCORE oceanographic expedition (see Charette et al., 2026), allowing for interannual comparison, while also expanding sample area coverage. During leg 4, between 5 September and 3 October 2024, an additional 17 oceanographic stations were sampled for a limited suite of ArcticCORE biological variables by our RA collaborators within Nares Strait and Sarvarjuaq (full oceanographic sampling occurred at these stations within the RA program).

A major component of the 2024 ArcticCORE oceanographic expedition was to recover and redeploy long-term oceanographic moorings, that had been deployed in this region the previous year. Six DFO-led moorings were successfully recovered, including the moorings at the entrance of the Lincoln Sea (LSea-23), within Archer Fiord (AF-23), Nares Strait (NaresE-23, Nares-WBAT, NaresW-23) and near Bylot Island (Bylot-23). The moorings within Archer Fiord (AF-24) and near Bylot Island (Bylot-24) were re-deployed to continue year-round monitoring of physical and biogeochemical conditions in these previously identified ecological hot spots. Both platforms are scheduled to be recovered in the following two years. Collectively, the resulting dataset from the 2024 ArcticCORE oceanographic expedition and moorings contribute to an improved understanding of seasonal characteristics of the oceanography and biogeochemical cycles of these regions and the connectivity of the Tuvaijuittuq cryosphere-ocean system with

downstream ecosystems to support future research, sustainable management, and conservation initiatives across this rapidly changing Arctic region.

3. PROGRAM PARTICIPANTS

Program Lead:

Lisa Matthes, Research Scientist, Fisheries and Oceans Canada

Principal Investigators:

David Capelle, Research Scientist, Fisheries and Oceans Canada

Mathieu Ardyna, Professor, Université Laval (Lead: Refuge Arctic)

Audrey Limoges, Professor, University of New Brunswick

Maxime Geoffroy, Professor, Memorial University of Newfoundland

Clark Richards, Research Scientist, Fisheries and Oceans Canada

Kevin Hedges, Research Scientist, Fisheries and Oceans Canada

Collaborators:

Jean-Éric Tremblay, Professor, Université Laval

Nigel Hussey, Associate Professor, University of Windsor

Sergei Kirillov, Research Associate, University of Manitoba

Field Participants (Leg 3):

Tonya Burgers, Physical Scientist, Fisheries and Oceans Canada, Field Lead

Elizabeth Kitching, Aquatic Science Biologist, Fisheries and Oceans Canada

Jillian Reimer, Aquatic Science Technician, Fisheries and Oceans Canada

Guillaume Barut, PhD Student, Université Laval

Juliette Provencher, Research Professional, Université Laval (Refuge Arctic Team)

During leg 4, the RA team, led by Dr. Ardyna, collected biological samples for the ArcticCORE program.

4. SAMPLING OVERVIEW

The 2024 ArcticCORE sampling program was carried out primarily during leg 3 of the 2024 CCGS *Amundsen* expedition (8 August to 5 September), with limited sampling performed during leg 4 (5 September to 3 October). Both legs 3 and 4 were conducted in collaboration with the RA research consortium, with leg 3 being primarily focused on understanding coastal marine dynamics in the glacier-influenced fjord systems of eastern Ellesmere Island, including Archer Fiord, Dobbin Bay, Cadogan Inlet, and Makinson Inlet. Scientific operations during leg 4 took place in the main channel of Nares Strait, focusing on regional sea ice conditions, hydrology, biogeochemistry, and biodiversity in this important passageway connecting the Arctic Ocean and Baffin Bay. During leg 3, a total of 22 stations were sampled between Bylot Island near the hamlet of Mittimatalik (Pond Inlet) to the south and the entrance to the Lincoln Sea to the north (Figure 2). Seven stations were located within Tuvaijuittuq, with the majority of stations located within the Lady Franklin Bay – Archer Fiord system. Additionally, six oceanographic moorings were recovered, with two moorings being re-deployed, one near Bylot Island and the other one in Archer Fiord. During leg 4, the RA team sampled 17 stations and collected an additional limited set of variables for the ArcticCORE program on top of their comprehensive oceanographic sampling strategy (Figure 3). A complete list of ArcticCORE sampling operations during leg 3 and leg 4 is shown in Table 1.

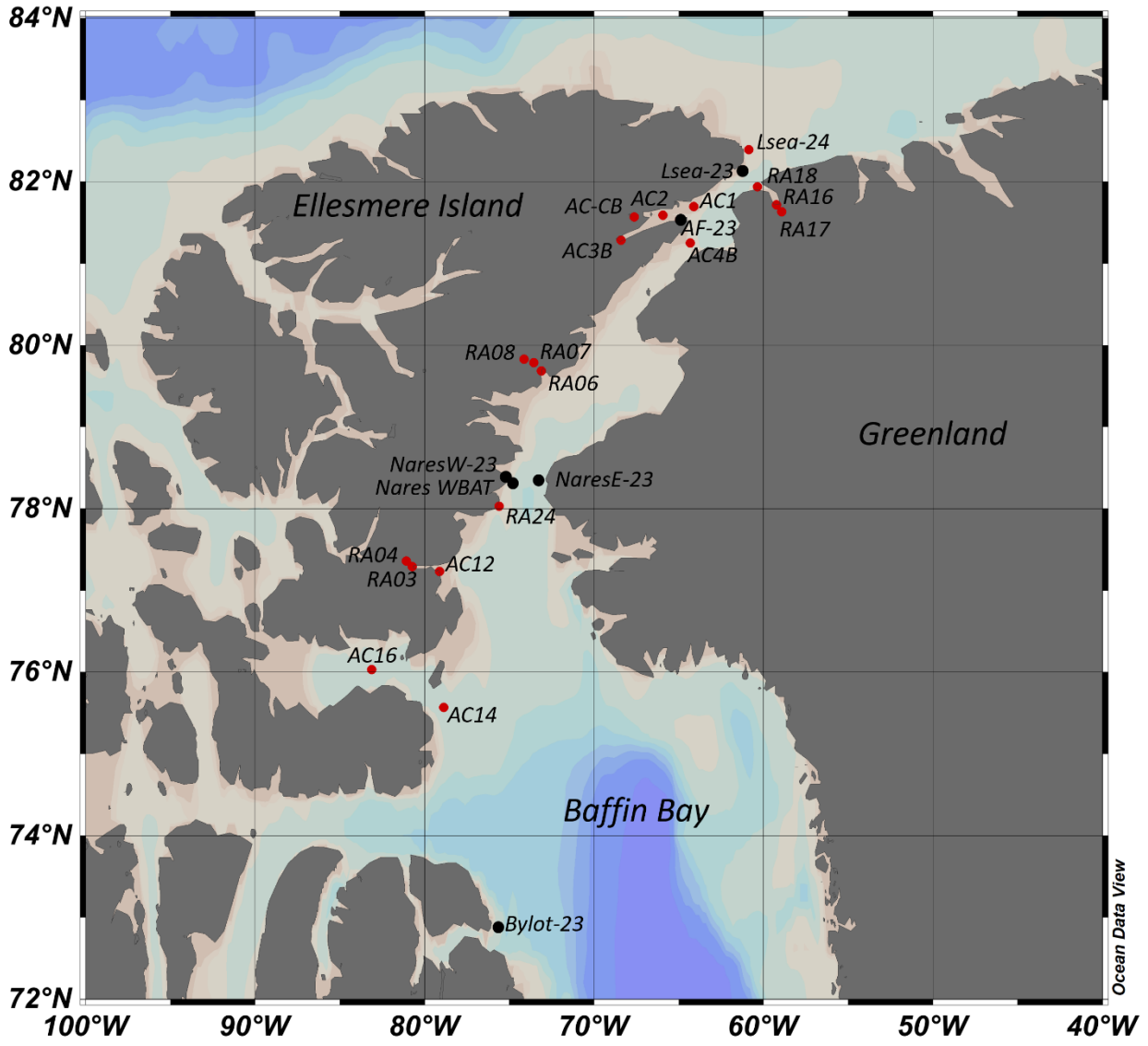


Figure 2. Location of stations sampled (red) and moorings retrieved/deployed (black) during leg 3 of the 2024 CCGS *Amundsen* expedition within the ArcticCORE and Refuge Arctic programs.

During leg 3 each sampling station was treated as a "full" station, with the ship spending between 8 and 12 hours on-site and conducting a series of sampling operations. The chief scientists for leg 3, Drs. Mathieu Ardyna and Audrey Limoges, coordinated all scientific operations with the Captain and crew of CCGS *Amundsen*. Dr. Tonya Burgers acted as the DFO field lead for the ArcticCORE project during leg 3. The Amundsen Science staff, led by Fatma Dhifallah, operated the conductivity, temperature and depth (CTD)-Rosette system. The ArcticCORE field participants worked in the following sampling teams:

- Water biochemistry: E. Kitching, J. Reimer, G. Barut, J. Provencher
- Water carbon chemistry: T. Burgers
- Zooplankton and fish: Carried out by Dr. Geoffroy's team including L. Vilgrain, E. Sandbank, F. Maps (Université Laval). Dr. Maxime Geoffroy's team also collected benthic underwater videos through deployments of a drop camera.

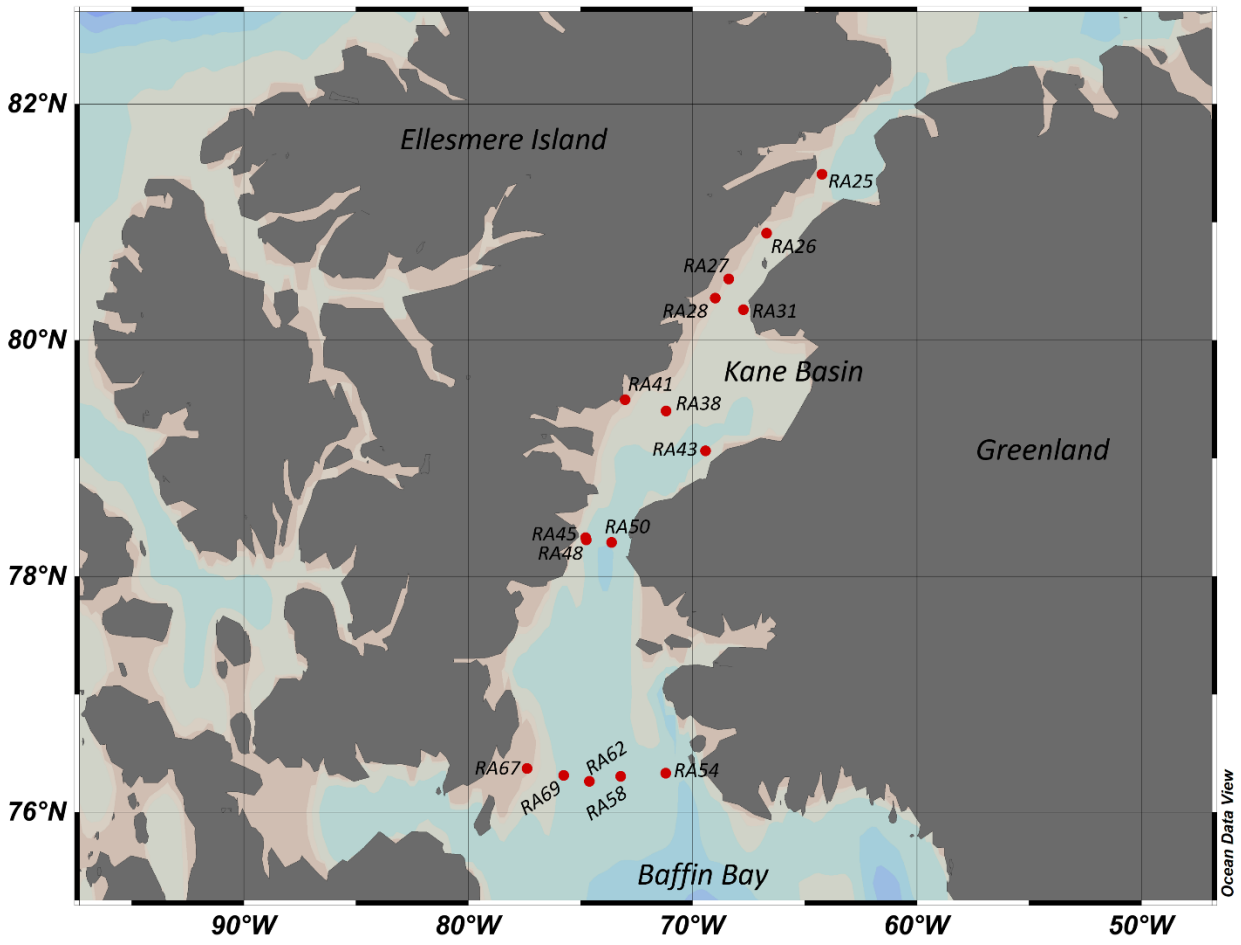


Figure 3. Location of stations sampled during leg 4 of the 2024 CCGS *Amundsen* expedition.

As outlined in Table 1, different types of stations were sampled. Most stations were sampled from the ship, using one CTD-Rosette cast for the collection of biological variables ("Biological", "Biological-limited" for leg 4) and another cast for the collection of chemical variables ("Chemical"). In addition to science operations conducted from the main ship, the barge was deployed to collect seawater closer to shore in the glacial fjord systems. Typically, barge sampling stations were planned to represent a spatial gradient between a freshwater source and waters in the

center of a fjord system. The helicopter was also deployed to collect samples directly from freshwater sources such as glacier ice, glacial melt ponds, rivers and lakes. A major goal of the scientific operations during leg 3 was to characterize the biogeochemical conditions of freshwater sources, and their impact on these fjord systems. The barge and helicopter were deployed for these purposes whenever weather conditions allowed. Further information about sampling operations, including the ship log for legs 3 and 4, can also be found in the 2024 CCGS *Amundsen* expedition report (Amundsen Science, 2024).

Table 1. Sampling operations conducted by the ArcticCORE team and by Refuge Arctic collaborators for the ArcticCORE program during legs 3 and 4 of the 2024 CCGS *Amundsen* expedition for each sampling day; X indicates the type of sampling completed. Sampled variables include water biochemistry (water biochem), carbon chemistry (carbon chem) and zooplankton sampling. Station ID refers to internal DFO station sample labels.

Leg	Station name	Station ID	Latitude (°N)	Longitude (°W)	Rosette cast	Date (yyyy/mm/dd)	Station type	Water biochem	Carbon chem	Zoo-plankton
3	**Bylot-23 / RA01**	18	72.8753	75.6480		2024/08/12	Mooring recovery			
3	**Bylot-23 / RA01**	18	72.8805	75.6540		2024/08/12	Mooring deployment			
3	**Bylot-23 / RA01**	18	72.8802	75.6482	2	2024/08/12	Biological	X		X
3	**Bylot-23 / RA01**	18	72.8820	75.6568	4	2024/08/12	Chemical		X	
3	**AC12 / RA02**	19	77.2334	79.1050	6	2024/08/14	Biological	X		X
3	**AC12 / RA02**	19	77.2419	79.1140	8	2024/08/14	Chemical		X	
3	**AC12 / RA02**	19	77.4250	80.7847		2024/08/14	Helicopter - glacier	X	X	
3	**AC12 / RA02**	19	77.2522	80.7775		2024/08/14	Helicopter - river	X	X	
3	**RA03**	20	77.2926	80.7373	9	2024/08/15	Biological	X		X
3	**RA03**	20	77.2935	80.7485	11	2024/08/15	Chemical		X	
3	**RA03**	20	77.2646	80.7388		2024/08/15	Barge - A	X	X	
3	**RA04**	21	77.3610	81.0820	13	2024/08/16	Biological	X		X
3	**RA04**	21	77.3624	81.0724	15	2024/08/16	Chemical		X	
3	**RA04**	21	77.3899	81.0444		2024/08/16	Barge - A	X	X	
3	**RA04**	21	77.3667	81.0278		2024/08/16	Barge - B	X	X	
3	**Nares West WBAT / RA05**	22	78.3157	74.7947		2024/08/17	Mooring recovery			
3	**Nares West WBAT / RA05**	22	78.3120	74.7739	17	2024/08/17	Biological, Chemical	X	X	
3	**RA06**	23	79.6832	73.0872	18	2024/08/18	Biological	X		X
3	**RA06**	23	79.6845	73.0974	20	2024/08/18	Chemical		X	
3	**RA06**	23	79.6965	73.1082		2024/08/18	Barge - A	X	X	
3	**RA06**	23	79.6965	73.1082		2024/08/18	Barge - B	X	X	

3	**RA07**	24	79.7855	73.5580	22	2024/08/19	Biological	X		X
3	**RA07**	24	79.7855	73.5689	24	2024/08/19	Chemical		X	
3	**RA07**	24	79.8536	75.0814		2024/08/19	Helicopter - glacier	X	X	
3	**RA07**	24	79.8119	72.8378		2024/08/19	Helicopter - river	X	X	
3	**RA08**	25	79.8291	74.1005	26	2024/08/20	Biological	X		X
3	**RA08**	25	79.8289	74.1187	28	2024/08/20	Chemical		X	
3	**RA08**	25	79.8499	75.0355		2024/08/20	Helicopter - lake	X	X	
3	**RA08**	25	79.8344	74.8484		2024/08/20	Barge - A	X	X	
3	**RA08**	25	79.8270	74.5730		2024/08/20	Barge - B	X	X	
3	**RA08**	25	79.8296	74.1726		2024/08/20	Barge - C	X	X	
3	**LSea-24 / RA09**	26	82.3984	60.8477	30	2024/08/22	Biological	X		X
3	**LSea-24 / RA09**	26	82.3913	60.8635	32	2024/08/22	Chemical		X	
3	**LSea-23 / RA10**	27	82.1349	61.2005		2024/08/22	Mooring recovery			
3	**LSea-23 / RA10**	27	82.1234	61.2348	34	2024/08/22	Biological, Chemical	X	X	
3	**AF-23 / RA11**	28	81.5417	64.9181		2024/08/23	Mooring recovery			
3	**AF-23 / RA11**	28	81.5431	64.8953		2024/08/23	Mooring deployment			
3	**AF-23 / RA11**	28	81.5371	64.9530	35	2024/08/23	Biological, Chemical	X	X	
3	**AC-CB / RA12**	29	81.5702	67.6127	36	2024/08/23	Biological	X		X
3	**AC-CB / RA12**	29	81.5679	67.6209	38	2024/08/23	Chemical		X	
3	**AC-CB / RA12**	29	81.6831	69.0153		2024/08/23	Helicopter - river a	X	X	
3	**AC-CB / RA12**	29	81.5178	68.7819		2024/08/23	Helicopter - river b	X	X	
3	**AC-CB / RA12**	29	81.7939	70.4519		2024/08/23	Helicopter - lake	X	X	
3	**AC-CB / RA12**	29	81.6667	68.9715		2024/08/23	Barge - A	X	X	

3	**AC-CB / RA12**	29	81.5829	68.4746		2024/08/23	Barge - B	X	X	
3	**AC-CB / RA12**	29	81.5226	68.5066		2024/08/23	Barge - C	X	X	
3	**AC-CB / RA12**	29	81.5690	67.6552		2024/08/23	Barge - D	X	X	
3	**AC3B / RA13**	30	81.2865	68.4000	40	2024/08/25	Biological	X		X
3	**AC3B / RA13**	30	81.2879	68.3968	42	2024/08/25	Chemical		X	
3	**AC3B / RA13**	30	81.2775	68.4810		2024/08/25	Barge	X	X	
3	**AC3B / RA13**	30	80.9389	70.8150		2024/08/25	Helicopter - glacier	X	X	
3	**AC3B / RA13**	30	81.0564	70.0611		2024/08/25	Helicopter - lake	X	X	
3	**AC3B / RA13**	30	81.0764	70.0122		2024/08/25	Helicopter - river	X	X	
3	**AC2 / RA14**	31	81.5892	65.9264	44	2024/08/26	Biological	X		X
3	**AC2 / RA14**	31	81.5864	65.9402	46	2024/08/26	Chemical		X	
3	**AC2 / RA14**	31	81.5226	68.5066		2024/08/26	Barge	X	X	
3	**AC1 / RA15**	32	81.7002	64.0851	48	2024/08/27	Biological	X		X
3	**AC1 / RA15**	32	81.6983	64.1180	50	2024/08/27	Chemical		X	
3	**AC1 / RA15**	32	81.6596	64.0590		2024/08/27	Barge	X	X	
3	**RA16**	33	81.7210	59.2285	52	2024/08/28	Biological	X		X
3	**RA16**	33	81.7198	59.2318	54	2024/08/28	Chemical		X	
3	**RA17**	34	81.6309	58.9165	57	2024/08/28	Biological	X		X
3	**RA17**	34	81.6297	58.9096	59	2024/08/28	Chemical		X	
3	**RA17**	34	81.3114	57.2325		2024/08/28	Helicopter - glacier	X	X	
3	**RA17**	34	81.5278	57.9836		2024/08/28	Helicopter - river	X	X	
3	**RA17**	34	81.6119	58.6910		2024/08/28	Barge - B	X	X	
3	**RA17**	34	81.6334	58.8516		2024/08/28	Barge - C	X	X	
3	**RA18**	35	81.9393	60.3560	60	2024/08/29	Biological	X		
3	**RA18**	35	81.9382	60.3627	62	2024/08/29	Chemical		X	
3	**AC4B / RA19**	36	81.2522	64.3241	63	2024/08/30	Biological, Chemical	X	X	
3	**AC14 /RA20**	37	75.5700	78.8628	64	2024/09/02	Biological, Chemical	X	X	X

3	**AC16/RA21**	38	76.0302	83.1170	65	2024/09/02	Biological, Chemical	X	X	X
3	**Nares East/RA22**	N/A	78.3187	73.1819		2024/09/03	Mooring recovery			
3	**Nares West/RA23**	N/A	78.3259	74.8786		2024/09/03	Mooring recovery			
3	**RA24**	39	78.0320	75.6005	68	2024/09/04	Biological	X		X
3	**RA24**	39	78.0318	75.6050	70	2024/09/04	Chemical		X	
3	**RA24**	39	78.1275	75.8706		2024/09/04	Helicopter - river	X	X	
3	**RA24**	39	78.0514	75.6786		2024/09/04	Helicopter - glacier	X	X	
4	**RA25**	40	81.4119	64.2373	73	2024/09/08	Biological - limited	X		
4	**RA26**	41	80.9072	66.7149	75	2024/09/09	Biological - limited	X		
4	**RA27**	42	80.5196	68.4038	76	2024/09/10	Biological - limited	X		
4	**RA28**	44	80.3438	69.0305	80	2024/09/11	Biological - limited	X		
4	**RA31**	43	80.2596	67.7556	84	2024/09/12	Biological - limited	X		
4	**RA36**	45	80.0694	69.5803	91	2024/09/13	Biological - limited	X		
4	**RA38**	47	79.4100	71.1461	93	2024/09/15	Biological - limited	X		
4	**RA41**	46	79.4979	73.0233	97	2024/09/16	Biological - limited	X		
4	**RA43**	48	79.0655	69.4389	100	2024/09/17	Biological - limited	X		
4	**RA45**	49	78.3290	74.7854	ND	2024/09/18	Biological - limited	X		
4	**RA48**	50	78.3070	74.8002	106	2024/09/19	Biological - limited	X		
4	**RA50**	51	78.2895	73.6176	111	2024/09/20	Biological - limited	X		

4	**RA54**	52	76.3343	71.2076	118	2024/09/23	Biological - limited	X	
4	**RA58**	53	76.3060	73.2145	126	2024/09/24	Biological - limited	X	
4	**RA62**	54	76.2629	74.6049	132	2024/09/25	Biological - limited	X	
4	**RA67**	55	76.3743	77.3948	140	2024/09/26	Biological - limited	X	
4	**RA69**	56	76.3158	75.7602	146	2024/09/26	Biological - limited	X	

4.1. Seawater biochemistry

Seawater was collected from the CTD-Rosette system onboard CCGS *Amundsen*, which consisted of a 24 x 12 L Niskin bottle Rosette carousel equipped with a Sea-Bird SBE 911 plus CTD profiler and additional sensors for dissolved oxygen (DO), coloured dissolved organic matter (CDOM) fluorescence, chlorophyll *a* fluorescence, transmissometer, photosynthetically available radiation (PAR, 400 – 700 nm), and nitrate. Continuous surface PAR measurements were collected by an upward facing radiometer on top of the ship's wheelhouse.

At each station during leg 3, there were two separate CTD-Rosette casts conducted; the first cast of the day was designated for the sampling of biological variables, and the second cast for chemical variables. At the onset of leg 3, the shallowest depth sampled by Rosette deployments was 5 m; however, starting at station LSea-24/RA09 (DFO Station ID 26), we added an additional 2 m to better capture the true surface water biochemistry. Table 2 provides an overview of sampled variables from the biological and chemical casts at each station, and Table 3 outlines which samples were collected by barge and helicopter operations. Samples were collected from the barge and helicopter using a surface pump and were either sampled directly into the sample storage bottle or into a triple-rinsed 20 L darkened sampling jug that was brought back to the ship for further processing (see Table 3 for the distinction of which variables were sampled when). Please note that this report only describes the collection of core variables that were carried out by the ArcticCORE team. The RA consortium carried out additional physical and biogeochemical sampling. Discrete samples were collected for the analysis of the following biochemical variables within the ArcticCORE program during leg 3 of the 2024 CCGS *Amundsen* expedition:

- Salinity
- Stable oxygen isotope ratio ($\delta^{18}O$)
- Dissolved inorganic carbon and total alkalinity concentrations (DIC/TA)
- Dissolved organic carbon concentration (DOC)
- Methane and nitrous oxide concentrations (CH_4/N_2O)
- Particulate organic carbon and nitrogen (POC/PN) and stable isotopes of carbon and nitrogen ($\delta^{13}C$ and $\delta^{15}N$)
- Chlorophyll *a* concentration (Chl *a*, total and >5 μm)

- Bacteria and protist abundance (Flow cytometry)
- Bacteria abundance (Epifluorescence microscopy, stained with DAPI)
- Phytoplankton taxonomic composition
- Phytoplankton fatty acid (FA) composition
- Phytoplankton enumeration and identification using the Imaging Flow Cytobot (IFCB)
- Fast repetition rate fluorometry (FRRF)

Table 2. Overview of biochemical variables collected within the ArcticCORE program during leg 3 of the 2024 CCGS *Amundsen* expedition. Collected replicates: 1x: single, 2x: duplicate samples. Acronyms include: SCM – Subsurface Chlorophyll *a* Maximum; Btm. – Bottom; DIC/TA – Dissolved Inorganic Carbon/Total Alkalinity; CH_4/N_2O – Methane and Nitrous Oxide; DOC – Dissolved Organic Carbon; S – Salinity; $\delta^{18}O$ – Oxygen isotopes; DAPI – Epifluorescence microscopy; Phyto taxo – Phytoplankton taxonomy; FA –Fatty Acids; POC/PN – Particulate Organic Carbon/Particulate Nitrogen; IFCB – Imaging FlowCytobot; FRRF – Fast Repetition Rate Fluorometry. During leg 4, only chlorophyll *a* and phytoplankton taxonomy were collected for the ArcticCORE program.

	Chemical cast					Biological cast									
Depth (m)	**DIC/ TA**	**CH_4/ N_2O**	**DOC**	**S**	**$\delta^{18}O$**	**Flow cytometry**		**DAPI**	**Chlorophyll *a***		**Phyto taxo[1]**	**Phyto FA**	**POC/ PN**	**IFCB**	**FRRF**
						Bacteria	**Protist**		**Total**	**>5 µm**					
2[2]	1x	1x	1x	1x	1x				2x	2x			1x	1x	
5	1x	1x	1x	1x	1x	2x	2x	2x	2x	2x	2x	2x	1x	1x	1x
10	1x	1x	1x	1x	1x				2x	2x			1x		
20	1x	1x	1x	1x	1x	2x	2x		2x	2x			1x	1x	
30	1x	1x	1x	1x	1x				2x	2x			1x		
SCM	1x	1x	1x	1x	1x	2x	2x	2x	2x	2x	2x	2x	1x	1x	1x
40	1x		1x	1x	1x	2x	2x		2x	2x			1x		
50	1x	1x	1x	1x	1x				2x	2x		2x	1x		
60	1x		1x	1x	1x	2x	2x		2x	2x			1x	1x	
80	1x	1x	1x	1x	1x	2x	2x		2x	2x			1x		
100	1x	1x	1x	1x	1x	2x	2x		2x	2x			1x		
150	1x	1x	1x	1x	1x										
200	1x			1x	1x										
250	1x	1x		1x	1x										
300	1x			1x	1x										
500	1x	1x		1x	1x										
750	1x	1x		1x	1x										
1000	1x	1x	1x	1x	1x										
Btm.	1x	1x	1x	1x	1x										

[1]One sample preserved with formalin, and one with Lugol's acidic solution

[2]2 m depth was only sampled from station LSea-24/RA09 (DFO Station ID 26) onwards

Table 3. Overview of additional opportunistic surface water sampling by barge or helicopter during leg 3 of the 2024 CCGS *Amundsen* expedition within the ArcticCORE program. Acronyms include: DIC/TA – Dissolved Inorganic Carbon/Total Alkalinity; CH_4/N_2O – Methane and Nitrous Oxide; DOC – Dissolved Organic Carbon; S – Salinity; $\delta^{18}O$ – Oxygen isotopes; POC/PN – Particulate Organic Carbon/Particulate Nitrogen; Phyto taxo – Phytoplankton taxonomy; IFCB – Imaging FlowCytobot.

Sample type	Sampled at sampling site					Subsampled upon return from sampling site						
	DIC/TA	CH_4/N_2O	S	$\delta^{18}O$	DOC	Flow cytometry		Chlorophyll *a*		Phyto taxo[1]	IFCB	POC/PN
						Bacteria	Protist	Total	>5 µm			
Helicopter	1x	1x	1x	1x	1x	1x	2x			1x*	1x	1x
Barge	1x	1x	1x	1x	1x	1x	2x	2x	2x	1x*	1x	1x

[1]Only preserved with Lugol's acidic solution

4.2. Zooplankton

Zooplankton for taxonomic and other analyses were collected using a Double Square Net (DSN) "*Tucker"* net (two 500 µm mesh size nets with 1 m^2 collection area and one auxiliary 50 µm mesh size net with a 10 cm diameter) to sample the upper 100 m of the water column in an oblique V-shaped tow. The actual depth of the *Tucker* net during deployment was monitored using a Kongsberg Maritime HiPAP MiniS34 cNODE acoustic transponder system (S/N# 17570) attached to the cable above the net. To better understand the biodiversity and distribution of meso- and macrozooplankton by depth and predominant water mass, depth-stratified vertical tows were carried out using a *Hydrobios* MultiNet closing net (200 µm mesh size, 0.5 m^2 collection area, 9 nets). The *Hydrobios* is equipped with a CTD to record temperature and salinity profiles while collecting biological samples. The multinet is deployed vertically from 10 m off the bottom to the surface, with a maximum reach of 1,000 m. The nets open and close sequentially while the sampler is pulled up through the water column. The depth at which the different nets open and close is programmed before deployment and the depths calculated are based on bottom depth. If station depths were too shallow to deploy the *Hydrobios*, vertical zooplankton tows were carried out using a 3-Net Vertical Sampler (3NVS) "*Monster*" net, consisting of two 1 m^2 nets (200 µm mesh size), and an external single 10 cm diameter net (50 µm mesh size) to investigate the zooplankton community over the whole water column depth. After collection, the zooplankton samples are preserved in 10% formalin solution by volume and stored for further taxonomic identification at Université Laval.

During leg 3 of the 2024 CCGS *Amundsen* expedition, a total of six *Monster*, 14 *Tucker* and 11 *Hydrobios* net deployments were completed to support ArcticCORE objectives (Table 4). Other net deployments were conducted as part of the Refuge Arctic program (further information is available in the 2024 CCGS *Amundsen* expedition report (Amundsen Science, 2024)). Because sea ice and meteorological conditions changed rapidly, several initially planned stations were cancelled, and other fjords than those originally targeted were sampled.

Table 4. Zooplankton net deployments (*Monster*, *Tucker*, *Hydrobios*) completed during leg 3 of the 2024 CCGS *Amundsen* expedition to support ArcticCORE program objectives. Station ID refers to internal DFO station sample labels.

Station name	Station ID	Date (dd-mmm-yy)	Latitude (°N)	Longitude (°W)	Monster	Tucker	Hydrobios
Bylot-23 / RA01	18	13-Aug-24	72.8730	75.6738		X	X
AC12 / RA02	19	14-Aug-24	77.2385	79.1222		X	X
RA03	20	15-Aug-24	77.2902	80.7156		X	X
RA04	21	15-Aug-24	77.3635	81.0728		X	X
RA06	23	18-Aug-24	79.6794	73.0678	X	X	
RA07	24	19-Aug-24	79.7857	73.5539	X	X	
RA08	25	20-Aug-24	79.8335	74.1668	X	X	
LSea-24 / RA09	26	22-Aug-24	82.3149	60.8882			X
AC-CB / RA12	29	24-Aug-24	81.5695	67.6361		X	X
AC3B / RA13	30	25-Aug-24	81.2877	68.3778		X	X
AC2 / RA14	31	26-Aug-24	81.5077	65.9736		X	X
AC1 / RA15	32	27-Aug-24	81.6735	64.0808		X	X
RA16	33	28-Aug-24	81.7069	59.2186	X	X	
RA17	34	29-Aug-24	81.6316	58.9136	X	X	
AC14 /RA20	37	2-Sep-24	75.5705	78.8662			X
AC16/RA21	38	2-Sep-24	76.0315	83.1223			X
RA24	39	4-Sep-24	78.0305	75.6057	X	X	

5. WATER BIOCHEMISTRY AND GENOMICS PROCESSING

Seawater was collected directly from the Rosette Niskin bottles into discrete sample containers to determine salinity, $\delta^{18}O$, DIC/TA, DOC, CH_4/N_2O, and for immediate analysis using the IFCB and FRRF. For all other biochemical variables, seawater was collected from the Rosette Niskin bottles into large-volume containers through tubing with an attached 350 µm mesh filter to remove large grazers, then subsequently sub-sampled in the ship's laboratory for each variable. Size-fractioned Chl *a* samples were analyzed onboard, whereas all other samples were preserved and stored for later analysis at the Freshwater Institute (DFO, Winnipeg) or other laboratories. Detailed field sampling procedures for each biochemical variable are provided below.

Salinity (S) and stable oxygen isotope ratios ($\delta^{18}O$): Salinity and $\delta^{18}O$ samples were collected in clear 125 mL and amber 30 mL high-density polyethylene (HDPE) bottles, respectively. Samples were tightly sealed with electrical tape and stored at 4°C in the dark until analysis. Oxygen isotope

samples were analyzed following Rosa et al. (2016). Salinity samples were analyzed at the Freshwater Institute in Winnipeg with a Portasal Salinometer (model 8410A; calibrated with IAPSO seawater salinity standard (S = 35 PSU)).

Dissolved inorganic carbon and total alkalinity concentrations (DIC/TA): Seawater was sampled directly from the Niskin bottle spigot into 250 mL borosilicate glass bottles using Tygon tubing, allowing the bottle volume to overflow three volumes. After a headspace of 1% by volume was created, the samples were spiked with 100 µL of saturated mercuric chloride solution and capped with tapered glass stoppers with three stripes of Apiezon M grease. The stoppers were then secured with rubber bands and plastic hose clamps, or electrical tape. The samples were stored in the dark at 4°C until further analysis following Dickson et al. (2007). A duplicate sample was collected for approximately every 10 samples collected. Depths for duplicate samples were selected by observing the temperature/salinity profiles of the CTD-Rosette downcast and identifying a sampled depth with very stable temperature and salinity conditions (usually located between 200 and 300 m).

Dissolved organic carbon (DOC): Seawater was sampled into an acid-washed 60 mL syringe. The syringe was rinsed three times before filling, then attached to an acid-washed Swinnex with a combusted 25 mm 0.7 µm Whatman GF/F filter. The sample volume was passed through the GF/F filter to fill 30 mL glass vials with septa. Each sample was preserved with 300 µL of 10% (2N) HCl and stored in the dark at 4°C until further analysis.

Methane and nitrous oxide concentrations (CH_4/N_2O): Seawater was sampled from the Niskin bottle spigot, through Tygon tubing, into a 60 mL borosilicate glass bottle. The sample bottle was allowed to overflow by three volumes while filling. Samples were spiked with 100 µL of saturated mercuric chloride solution, capped with a rubber stopper, and crimped to seal. The samples were stored in the dark at 4°C until further analysis.

Particulate organic carbon and nitrogen (POC/PN): One subsample of 2 L of seawater was filtered onto pre-combusted (450°C for 5 hours) 25 mm 0.7 µm Whatman GF/F filters. Filters were placed back into pre-weighed petri dishes and were dried in an oven for 8 hours at 65°C. Samples were flash frozen in liquid nitrogen and stored at –80°C until further processing.

Size-fractioned chlorophyll a concentration (Chl a): Duplicate 250 mL subsamples of collected seawater were filtered onto 25 mm 0.7 µm Whatman GF/F filters or 25 mm 5 µm Nucleopore membrane filters for determination of total and >5 µm Chl *a* concentration, respectively. Filters were placed in 20 mL glass scintillation vials filled with 10 mL of 90% acetone, where pigments were extracted at 4°C in the dark for 18-24 hours. Chl *a* concentrations were measured onboard the ship using a Turner Design fluorometer (model 10-AU) immediately after extraction, following Parsons et al. (1984). The fluorometer was calibrated using pure Chl *a* extract (*Anacystis nidulans*, Sigma) prior to the expedition.

Bacteria and protist abundance by flow cytometry: Photosynthetic pico- (<2 µm) and nanoeukaryotes (2-20 µm) and bacterial abundances were determined by flow cytometry. Duplicate 4 mL seawater samples were transferred into 5 mL cryovials pre-spiked with 25% glutaraldehyde Grade I (0.1 % final v/v concentration; Sigma-Aldrich G5882). Samples were kept at room temperature for 15 minutes and then frozen at –80°C until further analysis following Belzile et al. (2008).

*Bacteria abundance by epifluorescence microscopy, stained with DAP*I): To validate flow cytometry results, duplicate samples for bacterial abundance measurement by epifluorescence microscopy technique after staining with DAPI (4,6-diamidino-2-phenylindole) were collected at the surface and at the Subsurface Chlorophyll *a* Maximum (SCM). Ten (10) mL of seawater was sampled into a darkened scintillation vial and spiked with 100 µL of borate-buffered formaldehyde solution to a final concentration of 1% (v/v). Samples were capped, sealed with Parafilm, and stored at 4°C in the dark until further processing following Sherr et al. (1993).

Phytoplankton taxonomic composition: Photosynthetic eukaryote abundance and community composition were determined from 200 mL subsamples of seawater, collected in 250 mL HDPE bottles. At each sampled depth, one sample was preserved with 1 mL of borate-buffered formaldehyde solution, and one sample with 1 mL of acidic Lugol's solution (final concentration of 0.4%). Each sample was capped, sealed with parafilm and stored at 4°C in the dark until further processing. Samples spiked with acidic Lugol's solution were analyzed following the inverted microscope method (Lund et al., 1958).

Phytoplankton enumeration and identification using the Imaging Flow Cytobot (IFCB): Phytoplankton identification and enumeration (10-150 µm range) were performed using the

Imaging FlowCytobot (Olson and Sosik, 2007). Rosette samples were measured onboard the ship immediately after sampling, while glacier, river, and lake samples were preserved in 50 mL polypropylene tubes at –80°C after adding 0.1 % glutaraldehyde solution (v/v) and measured upon return from the expedition. To prevent clogging of the flow cell, samples were pre-filter during sampling on 150 µm Nitex mesh. For the analysis onboard, triplicate seawater subsamples of approximately 5 mL were injected through flow cells and pre-filtered through a 150 µm Nitex screen at the intake to prevent clogging of the flow cell. The cell concentration count and image taking were triggered by scattering, which was emitted by particles that crossed a 635-nm laser directed at the flow cell. A modified version of open-source IFCB software (https://github.com/OceanOptics/ifcb-tools, Sosik and Olson, 2007) was used for post-processing. Post-processing included image validation to only retain photosynthetic cells and image identification using the EcoTaxa web application (Ecotaxa, Picheral et al. 2017) in the EcoTaxa project n° 16198 and n° 16347.

Phytoplankton fatty acid (FA) composition: Duplicate 2 L subsamples were filtered onto pre-combusted (450°C for 5 hours) 47 mm 0.7 µm Whatman GF/F filters. Samples were placed in sterile 2 mL cryovials and stored frozen at –80°C until further processing.

Fast Repetition Rate Fluorometry (FRRF): Algal community photosynthetic parameters and gross primary production rates were estimated using a FastOcean FRR fluorometer and the Act2Run software (Chelsea Technologies). Subsamples of 2 mL of seawater were acclimated for at least of 15 minutes in the dark, before exposure to irradiance ranging from 0 to 2000 µmol photons m^{-2} s^{-1} for 40 to 120 seconds, with three dark periods of 20 seconds. Total exposition lasted 21 minutes and 40 seconds.

6. MOORINGS

The DFO-led mooring program is an integral part of the ArcticCORE and Knowledge and Ecosystem-Based Approach in Baffin Bay and Barrow Strait (KEBABB/S) programs. It was developed in partnership with academic collaborators from Memorial University of Newfoundland, the University of New Brunswick and Université Laval leading the RED-AO (Rapidly Changing Ecosystem Dynamics in the Arctic Ocean's Last Ice Area) project, and DFO collaborators. The goal of the mooring program is to complement ship-based discrete observations

with long-term physical (e.g., temperature and salinity) and biogeochemical (e.g., dissolved CO_2 and O_2 concentrations, vertical particle flux) mooring data and to investigate the connectivity and ecological linkages between the multiyear sea-ice dominated region of the Tuvaijuittuq MPA and the downstream ecosystems of the Sarvarjuaq MPA, the Tallurutiup Imanga Marine Conservation Area and Baffin Bay. During leg 3 of the 2024 CCGS *Amundsen* expedition, six ArcticCORE/RED-AO moorings that were initially deployed during the 2023 CCGS *Amundsen* expedition were successfully recovered (Table 5). These mooring were located at the entrance to Lincoln Sea (label "LSea-23"), Lady Franklin Bay – Archer Fiord system ("AF-23"), in Nares Strait ("NaresE-23", "NaresW-23", "Nares-WBAT") and near Bylot Island ("Bylot-23"). As highlighted in Table 5, all oceanographic sensors were recovered with each mooring. However, some did not log data due to sensor malfunctioning, flooding or a disconnected power supply (i.e. the fish tag receivers).

In 2024, moorings in the Lady Franklin Bay – Archer Fiord system ("AF-24") and near Bylot Island ("Bylot-24") were re-deployed in approximately the same location (Table 6). Instruments were programmed prior to the start of the expedition. Mooring recovery is scheduled in upcming years. Additional details on the design of the re-deployed moorings can be found in Appendix A of this report, while Section 50 ("Mooring Operations Leg 3") of the Amundsen expedition report (Amundsen Science, 2024) provides more information on the mooring operations on ship. The deployment team during leg 3 of the 2024 CCGS *Amundsen* expedition was lead by Christian Boutot (Amundsen Science) with assistance from Luc Michaud (Amundsen Science), Megan Lee (DFO), Elizabeth Kitching (DFO), Tonya Burgers (DFO), Audrey Limoges (University of New Brunswick), and the crew of the CCGS *Amundsen*.

Table 5. General information and configuration of moorings recovered during the 2024 CCGS *Amundsen* expedition within the ArcticCORE program. Acronyms include: ADCP: Acoustic Doppler Current Profiler; CTD: Conductivity, Temperature, Depth; DO: Dissolved Oxygen; Fluo: Chlorophyll *a* Fluorescence, CDOM: Colored Dissolved Organic Matter; Tu: Turbidity; PIT: Passive Integrated Transponder; WBAT: Wide Band Autonomous Transceiver.

Mooring ID	Latitude (°N)	Longitude (°W)	Deployment date (yyyy/mm/dd)	Recovery date (yyyy/mm/dd)	Station depth (m)	Instrument depth (m)	Instrument type	Instrument model	Recovery notes
LSea-23	82.1394	61.2261	2023/09/14	2024/08/22	485	316	Beacon	*NovaTech* Flasher Sat Beacon	
						316	ADCP	*Nortek* Continental 470kHz	No data logged
						317	CTD	*Seabird* MicroCAT SBE37SM	Data logged
						420	Sediments trap	*Technicap* PPS3/3 (24 bottles)	Recovered
						462	PIT Fish tag receiver	*Vemco* VR2AR	No data logged
						480	Acoustic releases (2x)	*Teledyne* Benthos R500	Released
AF-23	81.5389	64.9535	2023/09/12	2024/08/23	260	119	Beacon	*NovaTech* Flasher Sat Beacon	
						119	ADCP	*Teledyne* Sentinel V100	Data logged
						120	CTD with DO, Fluo, CDOM, Tu	*RBR* Maestro	Data logged
						199	CTD	*Seabird* MicroCAT SBE37SM	Data logged
						199	Turbidity	*RBR* Solo Tu	Flooded
						200	Sediment trap	*Technicap* PPS4/3 (12 bottles)	Recovered

						225	PIT Fish tag receiver	*Vemco* VR2AR	No data logged
						249	Acoustic releases (x2)	*Teledyne* Benthos R500	Released
NaresE-23	78.3240	73.1939	2023/09/20	2024/09/03	340	195	Beacon	*NovaTech* Flasher Sat Beacon	
						195	ADCP	*Teledyne* Sentinel V100	Data logged
						197	CTD	*RBR* Concerto	Data logged
						273	Sediment trap	*Technicap* PPS3/3 (24 bottles)	Recovered
						275	CTD	*Seabird* MicroCAT SBE37SM	Data logged
						314	PIT Fish tag receiver	*Vemco* VR2AR	No data logged
						332	Acoustic releases (x2)	*Teledyne* Benthos R500	Released
NaresW-23	78.3237	74.8851	2023/09/19	2024/09/03	307	206	Beacon	*NovaTech* Flasher Sat Beacon	
						206	ADCP	*Teledyne* Sentinel V100	Data logged
						208	CTD	*RBR* Concerto	Data logged
						281	Sediment trap	*Technicap* PPS3/3 (24 bottles)	Recovered
						283	CTD	*Seabird* MicroCAT SBE37SM	Data logged
						292	PIT Fish tag receiver	*Vemco* VR2AR	No data logged
						298	Acoustic releases (x2)	*Edgetech* Port LF	Released

Nares-WBAT-23	78.3175	74.8000	2023/09/19	2024/08/17	573	569	Beacon	*XEOS*	
						571	WBAT	*Kongsberg* WBAT	Data logged
						571	Acoustic releases (x2)	*Edgetech* CART	Released
Bylot-23	72.8807	75.6490	2023/09/01	2024/08/12	438	119	Beacon	*NovaTech* Flasher Sat Beacon	
						119	ADCP	*Teledyne* Sentinel V100	Data logged
						200	CTD with pH	RBR *Maestro*	Data logged
						200	Carbon dioxide	*Pro Oceanus*	No data logged
						250	Temperature, Pressure	*RBR* Duet	Data logged
						300	CTD	*Seabird* MicroCAT SBE37SM	Data logged
						350	Temperature, Pressure	*RBR* Duet	Data logged
						400	Temperature, Pressure	*RBR* Duet	Data logged
						400	Sediment trap	*Technicap* PPS3/3 (12 bottles)	Recovered
						400	Turbidity	*RBR* Solo	Data logged
						428	PIT Fish tag receiver	*Vemco* VR2AR	No data logged
						435	Acoustic releases (x2)	*Teledyne* Benthos R500	Released

Table 6. General information and configuration of moorings deployed during the 2024 CCGS *Amundsen* expedition within the ArcticCORE program. Acronyms include: CTD: Conductivity, Temperature, Depth; DO: Dissolved Oxygen; Fluo: Chlorophyll *a* Fluorescence, CDOM: Colored Dissolved Organic Matter; Tu: Turbidity; PIT: Passive Integrated Transponder.

Mooring ID	Location	Latitude (°N)	Longitude (°W)	Deployment date (yyyy/mm/dd)	Station depth (m)	Deployment depth (m)	Instrument type	Instrument model
AF-24	Archer Fiord	81.5431	64.8953	2024/08/23	259	119	Beacon	*NovaTech* Flasher Sat Beacon
						120	Acoustic doppler current profiler	*Nortek* Signature 250
						120	CTD with DO, Fluo, CDOM and Tu	*RBR* Maestro
						198	CTD	*Seabird* MicroCAT SBE37SM
						198	Turbidity	*RBR* Solo
						200	Sediment trap	*Technicap* PPS4/3 (12 bottles)
						240	PIT Fish tag receiver	*Vemco* VR2AR
						257	Acoustic releases (2x)	*EdgeTech* MFE release
Bylot-24	Bylot Island	72.8805	75.6540	2024/08/12	438	199	Beacon	*NovaTech* Flasher Sat Beacon
						200	Acoustic doppler current profiler	*Teledyne* Sentinel V100
						200	Carbon dioxide	*Pro Oceanus*
						200	CTD with DO	*Seabird* MicroCAT SBE37SM with SeaPhox
						317	Temperature, Pressure	*RBR* Duet
						350	Temperature, Pressure	*RBR* Duet
						400	Temperature, Pressure	*RBR* Duet
						400	Turbidity	*RBR* Solo
						420	Sediment trap	*Technicap* PPS3/3 (24 bottles)
						428	PIT Fish tag receiver	*Vemco* VR2AR
						435	Acoustic releases (2x)	*EdgeTech* MFE release

7. LOGISTICAL OVERVIEW AND RECOMMENDATIONS

The 2024 ArcticCORE oceanographic expedition was successful, with most sampling objectives achieved. Near the end of leg 3 on 31 August, the ship received a maritime search and rescue call out of Pond Inlet, Nunavut, and was re-directed for 48 hours. This interruption required replanning of scientific activities, and some planned sampling stations in Jones Sound were cancelled as there was limited time remaining before the end-of-leg crew change. However, the remainder of the ArcticCORE sampling and mooring recovery/deployment objectives were achieved. Deploying moorings in cold, icy waters presents unique challenges that often push instrument and battery capacities to their limits, triggering sensor malfunctions and data loss. These outcomes are beyond our control and highlight the restrictions of long-term deployments of autonomous platforms in polar waters and the importance of frequent in situ field sampling.

The ArcticCORE team benefitted from a set-up and well-stocked laboratory, prepared and left by the DFO team of the KEBABB program from the previous leg. This left sufficient time for the ArcticCORE team to complete necessary familiarization and safety briefings before sampling commenced. The laboratory space allocated to the ArcticCORE team and the general scientific capabilities of CCGS *Amundsen* were sufficient and contributed immensely to the overall successful execution of our sampling objectives. Furthermore, the ArcticCORE program and team benefitted from close collaborations with our academic partners at sea, which enabled an increase in spatial coverage and data collection in this data-poor, ecologically unique region.

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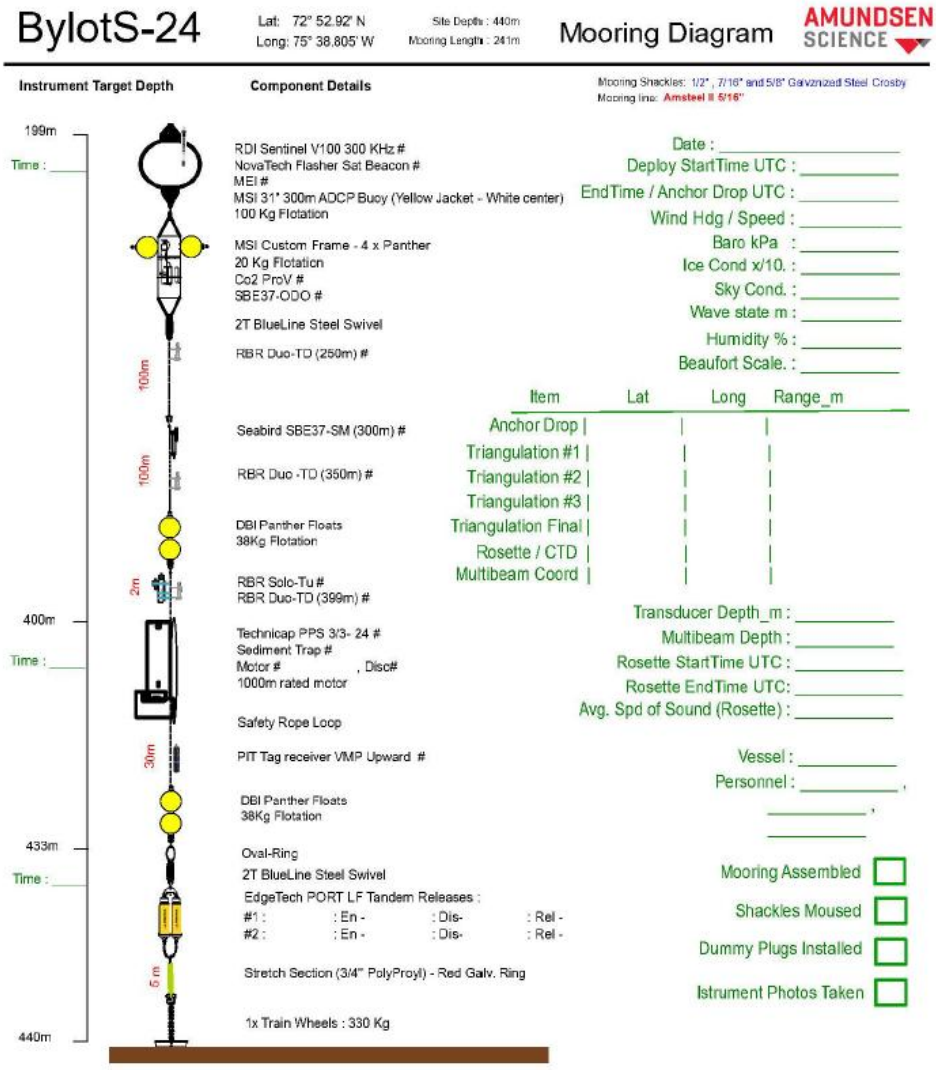
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Appendix

Appendix A. **Mooring diagrams of Bylot-24 and AF-24.**



AF-24

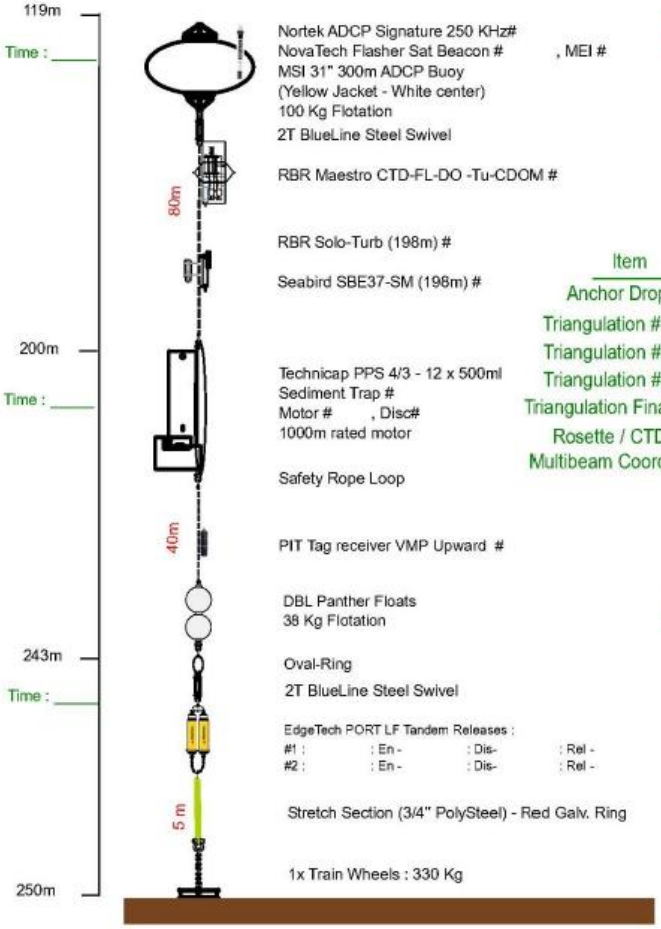
Lat: 81° 36.0' N
Long: 65° 12.0' W

Site Depth : 250m
Mooring Length : 131m

Mooring Diagram

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Mooring Shackles: 1/2" , 7/16" and 5/8" Galvanized Steel Crosby
Mooring line : Amsteel II 5/16"



Date : _____
Deploy StartTime UTC : _____
EndTime / Anchor Drop UTC : _____
Wind Hdg / Speed : _____
Baro kPa : _____
Ice Cond x/10. : _____
Sky Cond. : _____
Wave state m : _____
Humidity % : _____
Beaufort Scale. : _____

Item	Lat	Long	Range_m
Anchor Drop			
Triangulation #1			
Triangulation #2			
Triangulation #3			
Triangulation Final			
Rosette / CTD			
Multibeam Coord			

Transducer Depth_m : _____
Multibeam Depth : _____
Rosette StartTime UTC : _____
Rosette EndTime UTC: _____
Avg. Spd of Sound (Rosette) : _____

Vessel : _____
Personnel : _____ ,
_____ ,
_____

Mooring Assembled ☐
Shackles Moused ☐
Dummy Plugs Installed ☐
Istrument Photos Taken ☐